UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte THADDEUS SCHROEDER, MICHEL F. SULTAN and ANDRZEJ M. PAWLAK

Appeal No. 2005-1324
Application No. 09/663,030

ON BRIEF

Before McQUADE, NASE, and BAHR, Administrative Patent Judges.

NASE, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1 to 9. Claims 10 to 25, which are all of the other claims pending in this application, have been withdrawn from consideration.

We REVERSE.

BACKGROUND

The appellants' invention relates to an automotive steering system with a torque sensor (specification, p. 1). A copy of the dependent claims under appeal is set forth in the appendix to the appellants' brief. Claim 1, the only independent claim on appeal, reads as follows:

> An automotive steering system comprising:
> a shaft linked to a set of road wheels, the shaft including a slot parallel to the axis of the shaft and located at a single peripheral location about the surface of the shaft;
> a piezoresistive sensor positioned within and along the length of the slot and responsive as a cantilever beam to torque applied to the shaft and operative thereby to provide as output a signal indicative of the applied torque;
> a controller in signal communication with the sensor and operative thereby to accept as input from the sensor the signal indicative of the torque applied to the shaft; and
> a motor coupled to the shaft and in signal communication with the controller and operative thereby to accept as input from the controller a command to apply torque to the shaft.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Taig	4,655,092	April 7, 1987
Brosh et al. (Brosh)	5,398,194	Mar. 14, 1995
Buhl et al. (Buhl)	5,861,558	Jan. 19, 1999

Claims 1, 2 and 9 stand rejected under 35 U.S.C. § 103 as being unpatentable over Taig in view of Brosh.

Claims 3 to 8 stand rejected under 35 U.S.C. § 103 as being unpatentable over Taig and Brosh as applied to claims 1, 2 and 9 above, and further in view of Buhl.

Rather than reiterate the conflicting viewpoints advanced by the examiner and the appellants regarding the above-noted rejections, we make reference to the answer (mailed September 28, 2004) for the examiner's complete reasoning in support of the rejections, and to the brief (filed June 24, 2004) and reply brief (filed December 1, 2004) for the appellants' arguments thereagainst.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellants' specification and claims, to the applied prior art references, and to the respective positions articulated by the appellants and the examiner. Upon evaluation of all the evidence before us, it is our conclusion that the evidence adduced by the examiner is insufficient to establish a prima facie case of obviousness with respect to the claims under appeal. Accordingly, we will not sustain the examiner's rejection of claims 1 to 9 under 35 U.S.C. § 103. Our reasoning for this determination follows.

In rejecting claims under 35 U.S.C. § 103, the examiner bears the initial burden of presenting a prima facie case of obviousness. See In re Rijckaert, 9 F.3d 1531,

1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). A prima facie case of obviousness is established by presenting evidence that would have led one of ordinary skill in the art to combine the relevant teachings of the references to arrive at the claimed invention. See In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988) and In re Lintner, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

Taig's invention relates to torque sensors and more particularly to a sensor which produces an electrical signal as a function of the torque applied thereto and simultaneously provides mechanical coupling between two rotatable members. Torque transducers which generate an electrical signal as a function of the torque applied thereto, are well known. For example, such a torque transducer is disclosed in U.S. Pat. No. 4,415,054. Typically, this general type of torque transducer includes an input member and an output member which are connected one to the other by a torsion beam. When torque is applied to the input member, this torque is applied to the output member through the torsion beam thereby providing both a mechanical coupling between the input and output members and imposing a strain on the torsion beam. Various sensing devices such as strain gauges, Hall effect generators, and the like are affixed to the beam or to the beam and related members to produce an electrical signal whose magnitude, frequency, etc. is a function of the strain and, accordingly, the torque applied to the torsion beam. In these structures, it has been the common practice to

provide the torsion beam dimensions and configuration such that it functions both as a mechanical coupling between the input and output members and as a deformable element the deformation of which can be sensed to provide the desired electrical torque signal. Because the torsion beam must function both as a mechanical coupling and a deformable element the designer must select a suitable compromise between the strength and mechanical reliability of the torsion member and a member which will exhibit sufficient strain under normal loads to provide the desired electrical signal.

In one application of such torque sensors particularly relevant to Taig's invention, the sensor is utilized as a coupling member in an electrical power steering mechanism, the torque sensor providing a signal indicative of steering forces being applied to the mechanism by a driver. In this application, it will be recognized that the torque sensor, because it also provides mechanical coupling between the steering wheel and the steered wheels of a vehicle, must not fail. Simultaneously, in this application the normal torsion loads applied to the torsion beam may be substantially exceeded in circumstances such as the driver forcing the steering wheel against its stops, the vehicle striking a curb, and the like. When the torsion beam is subjected to such excessive loads, it is essential that the beam be protected against excess strain which could cause damage to the beam and/or the associated transducers affixed thereto. Simultaneously, it is essential that the torsion beam exhibit a sufficient amount of strain

under normal loads to produce an electrical signal of sufficient definition to enable precise and predictable control of the vehicle.

In its broader aspects, Taig's invention is a torque transducer coupling which comprises an input and an output member co-axially journaled for relative rotational movement. A torsion member connects the input and output members and a lost motion mechanism or coupling means connects the input and output members in response to a predetermined angular movement therebetween. Strain sensing means are fixed to the torsion member for generating an electrical signal as a function of the strain. More specifically, the transducer coupling is provided with a torsion beam which is fixedly secured at its opposite ends to the input and output members and a portion of the torsion beam positively keys the input to the output member at predetermined angular displacements therebetween whereby strain of the torsion beam is limited to said predetermined angular displacement and the input and output members are resiliently coupled by the torsion beam for relative angular movement having a displacement of less than said predetermined limit.

Brosh's invention relates to an electronic sensing circuit which is responsive to a physical parameter such as pressure or displacement. In particular, Brosh's invention relates to an electronic sensing circuit which can be used in place of a linear variable

differential transformer to provide sensor voltage outputs. Linear variable differential transformers (LVDT's) are routinely used as physical sensing elements, for example, as pressure transducers or for measuring small displacements. Brosh discloses an electronic sensing circuit having four piezoresistor elements in a Wheatstone bridge configuration. A source voltage is applied across a first pair of bridge points, and the resulting junction voltages appearing at a second pair of bridge points are applied to a pair of inverting amplifiers in balanced configuration which provide first and second output voltages which change relative to each other depending upon the direction and amount of pressure applied to the piezoresistor elements in a manner similar to the output voltages provided by an LVDT.

In the rejection under 35 U.S.C. § 103 before us in this appeal (answer, p. 3), the examiner ascertained that Taig does not disclose the strain sensing means as being a piezoresistive sensor and that it would have been obvious to use piezoresistive sensors since Taig is silent regarding a preferred type of resistor and since Brosh discloses that these are desirable and are readily commercially available for this purpose.

The appellants argue that the applied prior art does not suggest the claimed subject matter. Specifically, the appellants assert that the "piezoresistive sensor" limitation of claim 1 (i.e., a piezoresistive sensor positioned within and along the length

of the slot and responsive as a cantilever beam to torque applied to the shaft and operative thereby to provide as output a signal indicative of the applied torque) is not suggested by the combined teachings of Taig and Brosh. We agree. While Brosh discloses a piezoresistive sensor, Brosh provides no motivation, incentive, suggestion or teaching that would have made it obvious at the time the invention was made to a person having ordinary skill in the art to have modified Taig's strain sensing means to be a piezoresistive sensor. In our view, the only suggestion for modifying Taig in the manner proposed by the examiner to meet the above-noted limitation stems from hindsight knowledge derived from the appellants' own disclosure. The use of such hindsight knowledge to support an obviousness rejection under 35 U.S.C. § 103 is, of course, impermissible. See, for example, W. L. Gore and Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984).

For the reasons set forth above, the decision of the examiner to reject claims 1, 2 and 9 under 35 U.S.C. § 103 is reversed.

We have also reviewed the reference to Buhl additionally applied in the rejection of claims 3 to 8 but find nothing therein which makes up for the deficiencies of Taig and

Brosh discussed above. Accordingly, the decision of the examiner to reject claims 3 to 8 under 35 U.S.C. § 103 is reversed.

CONCLUSION

To summarize, the decision of the examiner to reject claims 1 to 9 under 35 U.S.C. § 103 is reversed.

REVERSED

JOHN P. McQUADE
Administrative Patent Judge

JEFFREY V. NASE
Administrative Patent Judge

JENNIFER D. BAHR
Administrative Patent Judge

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